RICE

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PHYS 501 : Physics of Ham Radio

DESCRIPTION | OVERVIEW | LEARNING GOALS | CLASS DETAILS | SCHEDULE | HOMEWORK

NEXT OFFERED: Fall 2020
MONDAY EVENINGS, 6 - 9 pm, HBH 233 (and 355, radio room)
Will be offered DUAL-MODE: in person and as synchronous remote participation via Zoom

DESCRIPTION

Fundamentals of electromagnetic waves and propagation, the ionosphere and space weather. Basic electronics, antenna design and safety. Provides information necessary to earn the "Technician" level of FCC amateur ("ham") radio license. Mathematics at a level below calculus. Other topics include: use of GPS, solar storms, magnetic reconnection and the MMS Mission, and geocaching.
Open to all undergraduate and graduate students - I will do registration overrides for undergrads wanting to take the course.

OVERVIEW

This class teaches the basics of electromagnetic waves, simple circuit and antenna theory, radio propagation, GPS theory and operation, ionosphere, magnetosphere, and space weather. The course midterm is the FCC "technician"-level ham radio test. It is expected that all students will pass the test before the end of the semester (retakes are acceptable), allowing legal broadcasting on all frequencies above 50 MHz (including popular 2m repeater networks and talking to the ISS) and selected HF frequencies. The second half of the course covers GPS and space weather topics. The students will have one general electrical circuit lab. Antenna installation costs were paid for by the Physics and Astronomy Department. NOTE: This class does count towards the "Master of Science Teaching" degree, but is a free elective ONLY for most other degree programs.

A short powerpoint on the uses of amateur radio or on the effects of space weather is required as one of the homework sets [View papers from 2007 Spring class | 2009 Spring class | 2013 Spring class]. All students who enrolled in the Spring 2007, 2009, 2010, 2011, 2013, and 2017 classes passed their "technician"-level FCC license exam, and several have passed their General level. One student who began as a "General" passed his "Extra" exam. Extra credit for passing higher levels before the end of finals.

Click here for an article about the success of the 2005 class, including their names and new callsigns, and more details about the class.

LEARNING GOALS

As a result of this class, the student is expected to:
1. Pass the "Technician" Level FCC ham license examination.
2. Be able to calculate wavelength from frequency and vice versa.
3. Be able to calculate voltage, current, resistance and power from simple DC and AC circuits, and resonant frequency of AC circuits.
4. Be able to calculate the length of antenna resonant with a given frequency.
5. Communication: be able to write a paper or powerpoint on the use of ham radio in emergencies or the effects of space weather.
6. Communication: Make at least ten legal ham radio contacts, 5 in HF and 5 in UHF/VHF.
7. Be able to understand and explain the formation of the ionosphere and calculate the critical frequency from the peak density.
8. Be able to explain the two modes of solar eruptions and the consequences of each.
9. Be able to use a GPS device to find location of hidden objects.
10. Be able to understand the interaction of the solar wind with the Earth's magnetosphere and predict consequences of solar flares and CMEs.

CLASS DETAILS

Take advantage of the NEW FCC RULES that NO LONGER REQUIRE MORSE CODE! If you don't have time to take the class, you can still join the Rice Ham Radio Club (Call W5YG). (Open to all hams and ham wanna-be's)

Instructor	Professor Patricia Reiff W5TAR (reiff@rice.edu); Phone: (713)348-4634; Office: HBH 226; Office hours by appointment
Classroom	HBH 223, 6:00 - 9:00 pm MONDAYS (Aug 24 - Nov 30) plus one field exercise (at Rice or remotely) Additional 4-5 radio nights as needed at HBH 355 (radio room)
Text	"Ham Radio License Manual **FOURTH EDITION ONLY**" (ARRL, $29.95, ISBN 978-1-62595-082-6 available from ARRL or Amazon.
Also helpful	A personal GPS receiver (will be provided for students who do not have one); calculator
Prerequisites	Basic algebra (no calculus)
Students accepted	This class is suitable for students of all levels: undergrad, grad student, and teachers, but at present does not count for restricted distribution. It is strongly recommended for teachers in the Master of Science Teaching program but may or may not count towards other graduate degree programs: check with your advisor. Auditors allowed up to the 19-person limit on enrollment. Remote participation possible by request.
Course Grading	Each homework set has a variable point count. Quiz 1 is the FCC Ham Radio "Technician" exam which will count 20 points when passed. Quiz 2 will count 30 points. Homework will count approximately 50 points, including a special report which will count 12 points. Final grade is the number of points earned divided by the points possible.
Absences	No specific penalty for absences except getting behind in the subject. One in-class laboratory if missed, requires special permission to make up. Several evening "on the air" sessions for practice in both voice and digital transmission modes, UHF and HF frequencies.
Honor Code	Students may work together on homework but each student shall turn in their own work. Quiz 1 is administered by VECs from the FCC. Quiz 2 is takehome, is subject to the honor code and must individual work and be signed.
Students with disabilities	Students needing accommodations should check with the instructor and also with the Disability Support Services. We will attempt every reasonable accommodation. For example, radio contacts can be made by digital modes for the hearing impaired.
Subject to Change	Details of the homework and schedule of class sessions are subject to change. All changes will be sent by email to all students enrolled in the course.

DETAILED SCHEDULE : NOTE SUBJECT TO CHANGE FOR 2020'S SCHEDULE

DATE	MATERIAL
Aug 24	Organizational meeting. Introduction to Ham Radio. Book Chapter 1 and 2A. ARRL Module 1 & 2.
DATE	**MATERIAL**
Aug 31	Book Chapter 2B and 3A. ARRL Modules 3 4 & 5.(Jan 20 = ADD DEADLINE)
DATE	**MATERIAL**
Sept 3	NO CLASS - LABOR DAY (will be rescheduled)
DATE	**MATERIAL**
Sept 5 (note different day)	Book Chapter 3B. ARRL Module 6. DC Circuit Lab.
DATE	**MATERIAL**
Sept 14	Book Chapter 3C. ARRL Modules 7. On the Air time.
DATE	**MATERIAL**
Sept 21	Book Chapter 4. ARRL Modules 8, 9 & 10. Antenna demos.

DATE	MATERIAL
Sept 26	Texas QSO Party
DATE	**MATERIAL**
Sept 28	Book Chapter 5 & 6. ARRL Modules 11 - 14.
DATE	**MATERIAL**
Oct 5	Book Ch 7-9. Modules 15 - 18. NOTE: Drop Deadline Feb 24
DATE	**MATERIAL**
Oct 12	Final topics for Exam
DATE	**MATERIAL**
Oct TBD	ARRL School Club Roundup (evenings on the air)
DATE	**MATERIAL**
Oct 19	Ham Radio Exam (or TBD)
DATE	**MATERIAL**
Oct 26	The Sun and Space Weather
DATE	**MATERIAL**
Nov 2	The Earth's Magnetosphere
DATE	**MATERIAL**
Nov 9	GPS; field exercise
DATE	**MATERIAL**
Nov 16	**Balloon and Digital modes**
DATE	**MATERIAL**
Nov 23	INDEPENDENT STUDY: ON AIR
DATE	**MATERIAL**
Nov 30	CLASS PRESENTATIONS

HOMEWORK (Fall 2020 (tentative))

- **Homework 1**: Waves and DC circuits
- **Homework 2**: DC circuits lab
- **Homework 3**: AC circuits
- **Homework 4**: Operation. Start your Ham log for homework 9.
- **Homework 5**: Antennas
- **Homework 6**: Sun and Space Weather
- **Homework 7**: Paper on Ham Radio in use, or space weather
- **Homework 8**: GPS Activity
- **Homework 9**: Turn in log sheets for your on the air contacts (5 UHF/VHF and 5 HF) (if not done previously)